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FACULTY WORKING PAPER NO. 1481

Modeling Government Behavior in Collective Bargaining: A Test for Self-Interested Bureaucrats

Jan K. Brueckner
Kevin M. O'Brien

WORKING PAPER SERIES ON THE POLITICAL ECONOMY OF INSTITUTIONS
NO. 14

College of Commerce and Business Administration
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Modeling Government Behavior in Collective Bargaining: A Test for Self-Interested Bureaucrats

by

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August 1988

Abstract

This paper tests for self-interested behavior by local-government bureaucrats engaged in collective bargaining with public employee unions. A theoretical model is developed that shows the effect of Niskanen-style bureaucratic self-interest in the two standard bargaining models: the demand-constrained model and the efficient-bargain model. These predictions are then tested using national cross-section data on unionized police, fire, and sanitation workers.

Modeling Government Behavior in Collective Bargaining: A Test for Self-Interested Bureaucrats

by

Jan K. Brueckner and Kevin M. O'Brien*

1. Introduction

A local government's labor costs, the most important element of local public expenditure, are frequently determined through a process of collective bargaining between the government and one or more public employee unions. Two distinct views of government behavior in this bargaining process are possible, with each view reflecting a different theory of bureaucracy. Under one view, government bureaucrats are seen as disinterested agents whose only desire is to serve the needs of their constituents. An alternative paradigm, however, portrays government bureaucrats as acting on the basis of selfish motives. Under this view, which originated in the work of Niskanen (1971) and others, bureaucrats attempt to secure the largest possible budgets to increase their power, compensation, and prestige.

This paper attempts to determine which of these views offers the more accurate description of local government behavior in the collective bargaining process. Such an inquiry is important because it reveals the extent of consumer sovereignty in local spending decisions and gives insight into the fiscal pressures felt by local governments. For example, it is frequently alleged that public employee unions extort excessive bargaining settlements from local governments and thereby damage their fiscal health. Indeed, many commentators pointed to costly union settlements as a prime cause of New York City's recent bankruptcy crisis. Under the benign view of bureaucratic behavior, such outcomes must be attributed to union strength (and perhaps

government weakness) at the bargaining table. The self-interested view leads, however, to a much different interpretation. Under this view, the notion of governments and public employee unions as natural adversaries loses its credence. Instead, union pressure may serve as a vehicle by which self-interested bureaucrats can secure large budgets under the guise of a collective bargaining process. The self-interested view thus radically alters the interpretation of public sector collective bargaining and suggests a new explanation for local fiscal distress.

The paper begins by offering a theoretical analysis of the effect of self-interest on the bargaining outcome under the two standard bargaining frameworks: the "demand-constrained" model, where the union chooses a point on the bureaucrat's demand curve for labor, and the "efficient-bargain" model of McDonald and Solow (1981), where bargaining outcomes are Pareto-efficient. Self-interest is shown to have clearcut effects on the position of the labor demand curve in the demand-constrained model and on the position of the contract curve in the efficient-bargain model. Since the appropriate bargaining framework cannot be established a priori, the empirical work tests for the effects of self-interest in both frameworks.[1]

The regression analysis uses three different cross-section samples of municipal employment data representing unionized police, fire, and sanitation workers. In the empirical work, the extent of bureaucratic self-interest in a city is measured by a community competition variable equal to the number of municipalities in the county containing the city. In the spirit of Tiebout (1956), the argument is that if there are many alternative communities nearby, then the bureaucrat must place more weight on constituent interests or risk population loss to other jurisdictions.

By providing the first theoretical treatment of bureaucratic behavior in collective bargaining, this paper extends existing theoretical work in the Niskanen tradition (for other contributions, see Migue and Berlanger (1974), Romer and Rosenthal (1979), Moene (1986), and the survey paper by Orzechowski (1977)). The paper also complements previous empirical work designed to test models of bureaucracy, a literature that contains a variety of different approaches. Ott (1980) and McGuire (1981), for example, recognize that the pursuit of large budgets will drive bureaucrats toward the unit elastic point on the constituent demand curve. Both authors look for evidence of this effect in their data. In a different vein, Romer and Rosenthal (1982) attempt to determine whether the outcomes of local spending referenda are affected by reversion budget levels, as predicted by their theoretical work. Using California data from before and after the passage of Proposition 13, Shapiro and Sonstelie (1982) test for structural change between the two periods in a model of local spending determination. They hypothesize that structural change would be observed only if Proposition 13 had restricted the freedom of budget-maximizing bureaucrats. Finally, in studies that are closely related to the present paper, Sjoquist (1982) and Mehay and Gonzalez (1986) investigate the effect of community competition on local spending per capita and public sector wages, respectively (competition is expected to lower both). Neither paper, however, presents a theoretical model to support its hypothesis.[2]

The present study also offers a contribution to the large literature on public sector labor markets. Papers in this area, many of which are devoted to estimating the effect of unions on public sector wages, include Ashenfelter (1971), Bartel and Lewin (1981), Edwards and Edwards (1982a,b), Ehrenberg (1973a,b), Ehrenberg and Goldstein (1975), Hall and Vanderporten (1977), Ichniowski (1980), Landon and Baird (1971), Nelson, Stone, and Swint (1981),

Schmenner (1973), and Zax (1985). Among these studies, papers that control for labor market monopsony effects bear an especially close relationship to the present research (see, for example, Ehrenberg and Goldstein (1975), Hall and Vanderporten (1977), and Landon and Baird (1971)). These papers include a community competition variable in their estimated wage equations, with the expectation that greater competition lowers the monopsony power of public employers and thus raises wages. In another closely related paper, Nelson, Stone, and Swint (1981) construct a model of public sector strike activity based on behavioral assumptions like those used below. They portray union leaders and government bureaucrats as acting on the basis of both self-interest and concern for their constituents.

Finally, by attempting to discriminate empirically between the demand-constrained and efficient-bargain models of collective bargaining, the paper joins a small recent literature directed toward this goal (see Eberts and Stone (1986) and MaCurdy and Pencavel (1986)). The present approach to discriminating between the models is novel and should be of interest to labor economists working in this area. In another related study, Brown and Ashenfelter (1986) estimate a bargaining contract curve using methods similar to ours.

The plan of the paper is as follows. Section 2 incorporates bureaucratic self-interest into the theoretical bargaining models and derives testable hypotheses. Sections 3, 4, and 5 discuss econometric issues, data, and empirical results. Section 6 offers conclusions.

2. Model

In setting up the model, we assume for simplicity that each community is composed of identical individuals. A representative consumer's inverse demand function for the public good q is given by $f(q,\beta)$, where β is a vector of

demographic variables that affect demand. Public consumption q in turn depends on public labor input L and on the population n of the community. Holding L fixed, q is decreasing in n as a result of congestion. In addition, since the demographic variables in β may affect the productivity of public inputs (see Hamilton (1983)), q also depends on β. Holding the number of fire hours L and population n fixed, for example, safety from fire will be greater in a higher-income community given the better condition of the housing stock. Public consumption thus can be written $q = h(L,n,\beta)$, with $h_L > 0$ and $h_n < 0$ (the signs of the elements of h_β depend on the identities of the demographic variables).

The demand function for public employee labor can be derived by substituting the h function into the demand function for q. This yields $F(L,n,\beta) \equiv f(h(L,n,\beta),\beta)$, where F is the inverse labor demand function, $F_L = f_q h_L < 0$, and $F_n = f_q h_n > 0$. The latter inequality shows that the demand for labor is higher in a larger community as a result of the congestion effect. The effect of the demographic variables on labor demand is given by the derivative $F_\beta = f_q h_\beta + f_\beta$. To appreciate the two forces affecting the sign of the elements of this vector, consider again fire protection and income. Since fire protection is undoubtedly a normal good, the income element of the vector f_β will be positive. However, since firemen are more productive in a higher-income community, the income elements of h_β and $f_q h_\beta$ are respectively positive and negative. The upshot is that the sign of the income element of F_β is ambiguous, reflecting the offsetting effects of income on demand for protection and the productivity of firemen. Since similar arguments can be made for other public services and demographic variables, the effect of the β vector on labor demand cannot always be predicted *a priori*.[3]

Letting w denote the hourly wage of public employees, aggregate consumer surplus as a function of w and L can be written

$$Z = \int_0^L nF(x,n,\beta)\,dx - wL$$

$$\equiv \int_0^L D(x,\alpha)\,dx - wL, \qquad (1)$$

where $D(L,\alpha) \equiv nF(L,n,\beta)$ is the aggregate demand for public employee labor in the community, with $\alpha \equiv (n,\beta)$. Note that since $F_n > 0$, $D_n > 0$ holds as well, indicating that aggregate demand for labor is higher in larger communities.

Bureaucrats in the model act on the basis of a strictly quasi-concave utility function $U(Z,L;\sigma)$ in which labor L appears as an argument along with Z (σ is a parameter discussed below). Bureaucratic self-interest means that in addition to caring about his constituents' surplus, the bureaucrat prefers a higher level of public employment (both partial derivatives U_Z and U_L are thus positive). While an alternative formulation more consistent with the Niskanen tradition would insert budget wL in place of L in the utility function, using labor as the self-interest variable simplifies the analysis without affecting the main results.[4]

The taste parameter σ reflects the strength of the bureaucrat's self-interest, with the marginal rate of substitution between Z and L assumed to be increasing in σ (in other words, the partial derivative of U_L/U_Z with respect to σ is assumed to be positive). An increase in σ thus makes the bureaucrat's indifference curves steeper in (L,Z) space, indicating decreased willingness to trade off L for Z (L is on the horizontal axis). Note that when the bureaucrat cares only about his constituents, U_L will be identically zero (σ then disappears from the utility function). In this case, the bureaucrat is said to be "constituency-interested" rather self-interested. For convenience, these

two behavioral modes will be referred to as CI and SI in the ensuing discussion.

In models in the Niskanen tradition, the bureaucrat's ability to exploit the consumer derives from assymmetric information. The bureaucrat's production costs are unknown to the consumer, which allows him to claim excessive costs in the pursuit of a large budget. A similar information assymmetry allows a local government bureaucrat to sacrifice consumer interests in the collective bargaining process. In particular, being ignorant of the details of the bargaining session, a constituent has no way of knowing whether an expensive settlement was due to union aggressiveness or to self-interest on the part of the bureaucrat.

We begin the analysis of bargaining outcomes by considering the demand-constrained model, under which the union chooses its preferred point on the employer's demand curve for labor. Once this analysis is complete, the discussion turns to the efficient-bargain model. To develop the demand-constrained model, the first step is to derive the properties of the bureaucrat's demand curve for labor. Labor demand is found by inserting (1) into the utility function and choosing L to maximize utility for a given wage. The first-order condition for this problem is

$$U_L/U_Z + D(L,\alpha) - w = 0 \qquad (2)$$

Since the derivative of the expression in (2) with respect to L (denoted A) is globally negative, satisfaction of the second-order condition for the problem is guaranteed.[5] To see how the degree of self-interest affects the position of the demand curve, consider first the constituency-interested case, where $U_L \equiv 0$. Inspection of (2) shows that in this case, the optimal L satisfies $D(L,\alpha) = w$. As a result, the bureaucrat's inverse labor demand curve under CI, denoted

$D^{CI}(L,\alpha)$, is identical to the constituent demand curve $[D^{CI}(L,\alpha) \equiv D(L,\alpha)]$. Under SI (where $U_L > 0$), rearrangement of (2) shows that the optimal L satisfies $D(L,\alpha) < w$. This means that at the optimal L, the height up to the constituent demand curve is less than the given wage. It follows, therefore, that the bureaucrat's inverse demand curve under SI, denoted $D^{SI}(L,\alpha,\sigma)$, lies above the constituent demand curve at a given L $[D^{SI}(L,\alpha,\sigma) > D(L,\alpha)]$. It is also easy to see that an increase in the self-interest parameter σ raises the D^{SI} curve. Letting L^* denote the optimal L, totally differentiating (2) yields $L^*_\sigma = -MRS_\sigma/A > 0$, where L^*_σ is the derivative of L^* with respect to σ and MRS_σ is the (positive) derivative of U_L/U_Z with respect to σ. Since L^* increases with σ, it follows that the inverse demand curve shifts to the right as σ increases. This in turn means that the height up to the curve at a given L increases as self-interest grows ($D^{SI}_\sigma > 0$). Demand curves in the SI and CI cases are shown in Figure 1.

Although the D^{CI} curve is always downward-sloping, the D^{SI} curve could have a positive slope, contrary to the situation shown in Figure 1. Differentiating (2), the inverse slope of D^{SI} is equal to

$$L^*_w = A^{-1}\{LU_Z^{-2}(U_{LZ}U_Z - U_{ZZ}U_L) + 1\} \qquad (3)$$

The sign of (3) depends on the sign of the term $U_{LZ}U_Z - U_{ZZ}U_L$, which tells whether L is a normal or inferior good in the bureaucrat's utility function. If L is noninferior (if the MRS increases or stays constant moving vertically in the (L,Z) plane), then this expression is nonnegative. The entire derivative expression in (3) is then negative (recall $A < 0$), indicating that the D^{SI} curve is downward-sloping. While noninferiority of L is thus sufficient for a negative slope, the same outcome will obtain as long as L is moderately inferior (as long as the first term inside the braces in (3) is

greater than -1). Given the plausibility of a negative slope, the D^{SI} curve is assumed to have this property in the following discussion.

A change in the demographic vector α naturally affects the position of the bureaucrat's demand curve. In the CI case, the bureaucrat's curve changes in step with the constituent curve since the two demands are identical. In the SI case, the effect of an increase in α on L^* is again found by totally differentiating (2), which yields

$$L_{\alpha}^{*} = -A^{-1}\{D_{\alpha} + U_{Z}^{-2}(U_{LZ}U_{Z} - U_{ZZ}U_{L})\int_{0}^{L} D_{\alpha}(x,\alpha)\,dx\}. \qquad (4)$$

The sign of (4) again depends on the sign of the term $U_{LZ}U_{Z} - U_{ZZ}U_{L}$. When L is noninferior and this term is nonnegative, it is clear from (4) that L_{α}^{*} and D_{α} have the same sign. Since the inverse demand curve shifts up (down) when L_{α}^{*} is positive (negative), it then follows that D_{α}^{SI} and D_{α} have the same sign, indicating that the bureaucrat's demand curve moves in the same direction as the constituents' curve when α increases. When L is inferior, on the other hand, the sign of (3) is ambiguous and no definite connection can be made between the movements of the two demand curves (moderate inferiority, however, preserves the above result). Despite this indeterminacy, it is clear that demographic variables help determine the position of the bureaucrat's demand curve and must be included in any empirical model.

With the analysis of the demand curve complete, we can now discuss the impact of self-interest on the bargaining outcome under the demand-constrained model. Under this model, the bureaucrat and the public employee union bargain over the wage, and the bureaucrat chooses the level of employment. These rules in effect allow the union to choose its preferred point on the bureaucrat's demand curve. In making this choice, it is assumed that the union acts on the

basis of the quasi-concave utility function $V(w,L;\delta)$, where δ is a "supply" parameter measuring the attractiveness of nonunion employment. McDonald and Solow (1981) use an expected utility approach to derive a particular form for this function. They assume that union members weight the utility of working at the union wage ($r(w)$) by the probability of union employment (L/N, where N is total union membership) and that they weight the utility of employment at the nonunion alternative wage ($r(w_a)$) by the probability of such employment ($1 - L/N$). The resulting expected utility is $(L/N)[r(w) - r(w_a)] + r(w_a)$, which is strictly quasi-concave in w and L as long as $r'' < 0$. The alternative wage w_a plays the role of δ in this function, and it is easy to see that an increase in w_a leads to flatter indifference curves. This property is reflected in our general formulation, with V_L/V_w assumed to be decreasing in δ.

Figure 1 shows the demand-constrained bargaining outcomes in the CI and SI cases, which are characterized by tangencies between union indifference curves and the two demand curves. While it is clear that a union is better off dealing with an SI bureaucrat (it reaches a higher indifference curve), no general comparison can be made between the (w,L) outcomes in the two situations. Both w and L could be higher in the SI case, as shown in Figure 1, but either w or L (but not both) could be lower under SI than under CI. The outcome depends on the positions and shapes of the union indifference curves and the bureaucrats' demand curves.[6] The same conclusion applies to a comparison between outcomes under different degrees of self-interest (different values of σ), which shift the SI curve: (w,L) comparisons are inconclusive. Given this indeterminacy, the empirical hypothesis regarding the effect of bureaucratic self-interest in the demand-constrained model is simply that bargaining outcomes are predicted to lie on a higher demand curve the greater the degree of self-interest.

It is worth noting that on the basis of a verbal argument, Mehay and Gonzalez (1986) predicted that wages would be lower in an environment where substantial community competition limits the pursuit of bureaucratic self-interest. As is clear from the above discussion, such an inference is illegitimate in the present model. In addition, Sjoquist's (1982) hypothesis that heightened community competition reduces per capita spending (and hence the size of the budget) does not follow from the present model. While an increase in budget (wL) is likely as self-interest increases, the tangency point on the higher demand curve could actually be located at a point where wL is lower than at the previous tangency.[7]

Additional empirical hypotheses relate to the effect of changes in the demographic variables and union supply variable. As in the case of self-interest, demographic changes have indeterminate effects on the bargaining outcome (the tangency point on the demand curve can move in a variety of possible directions as the curve shifts). All we can say is that the bargaining outcome will lie on a higher or lower demand curve depending on the direction of the impact of the demographic variable in question. Changes in the union supply variable, however, have a clearcut effect on the bargaining outcome. As δ increases (indicating better nonunion employment opportunities), indifference curves become flatter and the tangency point moves up along the demand curve, reducing L and increasing w.

The next step in the analysis is development of the efficient-bargain model. Bargaining outcomes under this model consist of tangency points between bureaucrat and union indifference curves, as explained further below. To develop the model, it is necessary to derive the properties of the bureaucrat's indifference curves in (w,L) space (these curves are closely related to the demand curve analysed above). An indifference curve is the locus of (w,L)

points such that $U(Z,L) = u$ for some u. Totally differentiating this equality to derive the slope of the implied indifference curve yields

$$dw/dL = [U_L/U_Z + D(L,\alpha) - w]/L \qquad (5)$$

Comparing (5) and (2), it is immediately clear that indifference curves are flat where they cross the demand curve. The reason is that the expression in (2) is zero along the demand curve, yielding a zero value for the slope expression (5). Moreover, since the derivative of (2) with respect to L is negative, it follows that (2) is positive to the left and negative to the right of the demand curve. Eq. (5) then implies that indifference curves are upward-sloping to the left and downward-sloping to the right of the demand curve, as shown in Figure 2 (utility increases in the downward direction). To see that for a given wage, the utility-maximizing L in fact lies on the labor demand curve, note that this L value is given by a point of tangency between an indifference curve and a horizontal wage line. Since this tangency occurs at the peak of an indifference curve, it does indeed lie on the labor demand curve.

To derive testable implications from the efficient-bargain model, the effect of self-interest on the bureaucrat's indifference curves must be analysed. Inspection of (4) shows that the indifference curve slope is numerically larger when when U_L is positive than when U_L equals zero. Therefore, when the bureaucrat exhibits SI, the indifference curve passing through a given point has a larger slope (more positive or less negative) than when he exhibits CI. This comparison, which is consistent with the relative positions of the demand curves, is shown in Figure 2. It is also easy to see that an increase in the parameter σ in the SI case numerically increases the slope of indifference curves. This follows because the derivative of (4) with

respect to σ, which equals MRS_{σ}/L, is positive. Thus, an increase in the strength of self-interest makes the indifference curve slope more positive or less negative at each point in the (w, L) plane.

The bureaucrat's indifference curves are also affected by changes in the demographic variables. Computation shows that the derivative of the slope expression (5) with respect to α has the same sign as the L^*_{α} expression in (4). Recalling that the bureaucrat's inverse demand curve shifts up (down) whenever (4) is positive (negative), it follows that indifference curve slopes increase (decrease) when a demographic change raises (lowers) the bureaucrat's demand curve.

With the above background, outcomes under the efficient-bargain model can be characterized. Under this model, the bureaucrat and the union are assumed to bargain over both the level of employment and the wage. Since the parties will never agree to a bargain that leaves unexploited gains under these rules, admissible bargaining outcomes consist of Pareto-efficient points in the (w, L) plane. As long the bureaucrat's indifference curves exhibit the proper curvature, this set of bargains is the locus of points where bureaucrat and union indifference curves are tangent.[8] A portion of this locus, which is called the contract curve, is shown in Figure 3 (note that the demand-constrained bargain lies off the contract curve).[9] It is important to realize that while an upward-sloping contract curve like the one shown in Figure 3 is a natural outcome, a downward-sloping curve cannot be ruled out in the present model. McDonald and Solow were able to exclude this possibility in their model, which has a simpler demand structure than ours.[10]

The degree of bureaucratic self-interest affects the position of the contract curve through its effect on indifference curves. Recall from above that a movement from CI to SI numerically increases the slope of indifference

curves, as does an increase in self-interest in the SI case. Since indifference curves are downward-sloping in the vicinity of the contract curve, an increase in self-interest therefore flattens the curves in this region. Referring to Figure 4, it is clear that this slope change moves the tangency point on a given union indifference curve downhill along that curve. When the contract curve is upward-sloping, as in Figure 4, it is clear that a series of these tangency movements has the effect of shifting the curve to the right.

The same principle can be used to derive the impact of changes in the demographic and union supply variables. Recall that any demographic change that raises the bureaucrat's demand curve also increases the slope of his indifference curves. A demographically-caused increase in demand thus flattens the indifference curves in the vicinity of the contract curve. As in Figure 4, this slope change shifts the contract curve to the right. On the other hand, since an increase in the union supply variable δ flattens the union indifference curves, it follows that the tangency point on a given bureaucrat indifference curve moves uphill along that curve as δ increases. It is clear from a redrawn Figure 4 that a series of such tangency changes shifts the contract curve to the left.

When the contract curve is downward-sloping, parameter changes have an indeterminate effect on the position of the curve. This can be seen by referring to Figure 5, which shows two sets of contract curves based on different families of union indifference curves. In the case where the contract curve is steep, cutting the indifference curves from above (case A in the Figure), it is easy to see that a flattening of the bureaucrat's indifference curves shifts the curve to the right. However, when the contract curve is flatter, cutting the indifference curves from below (case B), a flattening of the bureaucrat's indifference curves shifts it to the left. Note

that in both cases, the tangency point on a given union indifference curve moves downhill along that curve as the bureaucrat's indifference curves flatten. The effect of such changes on the overall position of the contract curve depends, however, on the curve's orientation relative to the indifference curves.[11]

As before, a flattening of the union indifference curves in response to an increase in the supply parameter δ has an impact opposite to the above. In particular, the contract curve shifts to the left (right) in case A (B) as the union indifference curves flatten. As will be seen below, the fact that flatter union and bureaucrat indifference curves lead to opposing shifts in the contract curve in this otherwise ambiguous situation proves very useful in evaluating the empirical results.

The predicted effect of bureaucratic self-interest on the position of an upward-sloping contract curve is the main testable implication emerging from the efficient-bargain model. Details of the empirical procedure for testing this hypothesis and the previous hypothesis from the demand-constrained model are discussed in the next section of the paper.

3. Econometric Methodology

It is useful to discuss econometric methodology in some detail to appreciate the differences between the estimation problems in the demand-constrained and efficient-bargain cases. To do this, let $w = \Omega^V(L, \delta, v)$ represent the equation of the union indifference curve with utility level v. In an empirical model, the demand-constrained bargaining outcome under SI then represents the solution to the following stochastic equation system:

$$w = D^{SI}(L, \alpha, \sigma) + \mu_0 \qquad (6)$$

$$w = \Omega^V(L, \delta, v) + \mu_1 \qquad (7)$$

$$D_L^{SI}(L,\alpha,\sigma) = \Omega_L^V(L,\delta,v) + \mu_2, \tag{8}$$

where the μ_i are error terms. The endogenous variables in this system are w, L, and the utility level v. Note that (6) and (7) state that the demand and indifference curves touch at the bargaining outcome (subject to a stochastic error) while (8) says that the intersection involves a tangency (subject again to an error). To estimate the demand curve in (6), L on the right hand side must be treated as endogenous, with the equation estimated using a method such as two-stage least squares. The exogenous variables in the reduced form are then α, σ and δ.

Letting $w = \Omega^U(L,\alpha,\sigma,u)$ give the equation of the bureaucrat's indifference curve with utility level u, the equations characterizing an efficient bargain are

$$w = \Omega^U(L,\alpha,\sigma,u) + \Phi_0 \tag{9}$$

$$w = \Omega^V(L,\delta,v) + \Phi_1 \tag{10}$$

$$\Omega_L^U(L,\alpha,\sigma,u) = \Omega_L^V(L,\delta,v) + \Phi_2, \tag{11}$$

where the Φ_i again are error terms. Eqs. (9) and (10) state that the bureaucrat and union indifference curves touch, and (11) says that the intersection involves a tangency (again subject to errors). Since this system has four endogenous variables (w,L,u,v) but only three equations, another equation is needed to close it. This equation tells where on the contract curve the bargaining outcome lies. Letting Y denote a vector of variables representing the bargaining strengths of both parties, the missing equation can be written

$$u = G(Y) + \Phi_3. \tag{12}$$

This equation shows how the bureaucrat's achieved utility level depends on his own bargaining strength as well as that of the union. Note that once u is determined, a value for v follows automatically.

To derive an estimating equation from the above system, (9), (10) and (11) are solved simultaneously for u and v in terms of L, α, σ, δ, Φ_0, Φ_1, and Φ_2. The u solution is substituted into (9) to yield

$$\begin{aligned} w &= \Omega^U[L,\alpha,\sigma,u(L,\alpha,\sigma,\delta,\Phi_0,\Phi_1,\Phi_2)] + \Phi_0 \\ &\equiv \Gamma(L,\alpha,\sigma,\delta,\Phi_0,\Phi_1,\Phi_2), \end{aligned} \tag{13}$$

which gives the equation of the contract curve. Note that the position of the curve depends on the exogenous variables α, σ, and δ as well as on three error terms. Note also that since w is the dependent variable in (13), the discussion of shifts in the contract curve in response to an increase in α or σ must be reoriented. In particular, the predicted rightward shift in an upward-sloping contract translates into a downward shift in the w direction (see Figure 4). This implies negative coefficients for the α and σ variables in (13).

To close the reduced model, the u solution is substituted into (12), yielding

$$u(L,\alpha,\sigma,\delta,\Phi_0,\Phi_1,\Phi_2) = G(Y) + \Phi_3. \tag{14}$$

Eqs. (12) and (13) determine w and L as functions of the exogenous variables (including Y) and the errors. Note that the reduced equation system is recursive in that (14) determines L directly and (13) then determines w. While this suggests that the contract curve in (13) should be estimated by ordinary least squares, this procedure will in fact yield inconsistent estimates. The reason is that the stochastic parts of the two equations share common elements

(Φ_0, Φ_1, Φ_2), which makes a technique such as two-stage least squares appropriate even though the system is recursive. The exogenous variables in the reduced form would be α, σ, δ, and the bargaining-strength variables Y.

Note that despite similarities, the estimation strategies for the two models show key differences. In the demand-constrained case, w is regressed on L, α, and σ, with L treated as endogenous and the union supply variable δ added as an exogenous variable in the reduced form. In the efficient-bargain case, however, w is regressed on L, α, and σ and on the union supply variable δ, with the bargaining-strength variables Y added as exogenous variables in the reduced form. From above, the coefficient of the bureaucratic self-interest variable σ should be positive in the demand-constrained model (the estimated demand curve should shift up) and negative in the efficient-bargain model as long as the contract curve is upward sloping (the contract curve should shift down in this case). Of course, since both models cannot be accurate representations of the bargaining process, it would be surprising (and disconcerting) if both these predictions held. As will be seen, however, the empirical results for one of the models are not internally consistent, which provides a way of discriminating between them.

4. Data

To gather data for the empirical work, the 1982 Census of Governments Bargaining Units Tape was used to identify cities with bargaining units for police, fire, or sanitation employees. Although the presence of a bargaining unit does not always mean that employees are covered by a collective bargaining agreement, this is usually the case in bargaining-unit cities.[12]

Excluding cities with populations below 25,000 yielded a police sample with 310 municipal observations, a fire sample with 283 observations, and a sanitation sample with 37 observations. For each city, data from the 1982

Municipal Yearbook were used to compile the *L* variable (measured in work hours) and *w*, represented by the labor cost per hour (computed by dividing total compensation, including fringe benefits, by work hours).[13]

The following demographic variables (representing α) were collected from the 1983 County and City Databook, with the variable name and year of collection in parentheses: population (POP, 1980); population density (POPDEN, 1980); median family income (MEDINC, 1979); percentage of the population nonwhite (NONWHT, 1980); percentage of the population with a high school degree (HSDEG, 1980). In addition, two additional variables measuring price effects were included in the empirical model. These are median house value (MEDVAL, 1980) and the percentage of government revenue from outside sources (IGOVREV, 1981), which determines the cost of a given wage bargain to a city's residents (the source for these variables is the County and City Data Book). It can be shown that by increasing consumer surplus, an increase in IGOVREV raises the bureaucrat's demand for labor as long as *L* is normal (see above).[14]

Two variables were selected to measure the attractiveness of nonunion employment (represented above by δ). These are the average manufacturing wage in the county containing the city in question (MFGW, 1980), collected from the County and City Data Book, and the state unemployment rate (UNEMP, 1980) collected from the Statistical Abstract of the United States. A number of variables were chosen to measure bargaining strength (*Y* above). The most important of these is the percentage of the public employees in the state that are unionized (UNION, 1980), collected from the Directory of U.S. Labor Organizations. Another measure is a dummy variable indicating the city's form of government (FGOVT, 1980) which assumes the value zero for the mayor-city council form and one for the city manager form (city managers are expected to be skilled bargainers). This variable was collected from the Municipal

Yearbook. Finally, on the belief that there may be regional differences in bargaining strengths, regional dummies were also included as explanatory variables. The variables, REGNE, REGNC, and REGW, represent the northeast, north central and western states respectively (the default region is the south).

As mentioned above, the strength of bureaucratic self-interest is measured by a community competition variable (denoted COMP) equal to the number of municipalities with populations over 25,000 in the county containing the city in question. This variable was compiled by referring to maps in the 1980 Census of Population. The reason for choosing this measure is that if there are many communities nearby, the bureaucrat must place more weight on constituent interests or face the threat of emigration to other jurisdictions. It is important to note that a higher value of COMP is assumed to alter the utility function underlying the bureaucrat's behavior (by lowering σ). It might be argued instead that a higher COMP should tighten a constraint faced by the bureaucrat without changing his preferences. For example, by indicating a greater range of consumer choice, a higher value of COMP might raise the minimum utility that the bureaucrat must guarantee to his constituents but would not affect the extent of his own self-interest. Such an approach, however, turns out to be unworkable in the above theoretical framework. In any case, the present approach can be justified by arguing that bureaucrats who survive in office have utility functions that reflect the maximum amount of self-interest that is sustainable given the amount of competition they face from other communities.

5. Empirical Results

We begin by presenting the results from estimation of the contract curve. Table 1 presents two-stage least squares (2SLS) estimates of log-linear

contract curves for the three samples with the wage as dependent variable. Along with L, the right-hand variables include the demographic variables listed above as well as the union supply variables MFGW and UNEMP. Additional exogenous variables in the reduced form are the bargaining-strength variables UNION and FGOVT and the regional dummies. The first thing to note about the results is that the estimated curves are downward-sloping, with the L coefficients significantly negative in each case. While this outcome is possible in principle in the model, its unnaturalness suggests that the estimated relationships may not represent contract curves. This suspicion is confirmed by further inspection of the coefficients, which show a fundamental inconsistency in the results. To see the problem, recall that while the effects of parameter changes on the position of a downward-sloping contract curve are indeterminate, the curve's response to a flattening of the bureaucrat's indifference curves is the reverse of its response to a flattening of the union's indifference curves (see Figure 5 and the associated discussion). The estimates in Table 1 violate this requirement since, in each case, an increase in population (which is expected to flatten the bureaucrat's curves) and an increase in the manufacturing wage (which flattens the union curves) both lead to an upward shift in the estimated curve (with the exception of MFGW in the sanitation equation, all the relevant coefficients are significant). This inconsistency suggests that the estimated relationships cannot be viewed as contract curves.

This negative result contrasts with the findings of Eberts and Stone (1986) and MaCurdy and Pencavel (1986), who discriminate between the efficient-bargain and demand-constrained models on the basis of nested hypothesis tests that favor the former model. In a sense, the present test is more stringent than theirs because the regressions are meant to estimate the entire contract

curve rather than equations corresponding to first-order conditions. It is therefore not surprising that the efficient-bargain model fails in the present context. It should also be noted that Brown and Ashenfelter (1986) estimate a contract curve using an approach similar to ours, although they are interested in very different issues. Their estimated contract curve, which like ours has both supply and demand variables on the right-hand side, is used to test the hypothesis of "strong efficiency," under which employment is affected by the alternative wage but is insensitive to the contract wage. This hypothesis is rejected.

Turning to the demand-constrained model, Table 2 presents both linear and log-linear 2SLS estimates of an equation corresponding to the bureaucrat's demand curve. The regressions differ from those in Table 1 in that the union supply variables MFGW and UNEMP do not appear in the second-stage equation. These variables are included in the reduced form along with UNION, the regional dummies, and the demographic variables. Although there is no rigorous rational for the appearance of UNION and the regional variables in the reduced form (these were viewed above as bargaining-strength measures), this specification yielded the most satisfactory demand estimates.

Referring to Table 2, the *L* coefficients are significantly negative in four out of six estimated equations, indicating downward-sloping demand curves. The emergence of negative coefficients is not surprising given that the Table 1 slopes are also negative and the model specifications are quite similar.[15] Focusing on the demographic variables, the population coefficients in Table 2 are usually positive and significant, indicating higher demands for public employees in larger cities. Also, the impact of population density on demand is significantly positive in every equation, confirming expectations. Income coefficients are significant, however, only in the police equations, indicating

higher demand for police in richer communities. The absence of income effects in the fire and sanitation equations contradicts earlier estimates derived from reduced-form expenditure equations (see Bergstrom and Goodman (1973) and Borcherding and Deacon (1972)). However, the discussion in section 2 showed that a perverse income effect is plausible when the productivity of public (especially fire) employees increases with the income level of the community.

A better educated population has no apparent effect on the demand for any of the services, with the HSDEG coefficients in Table 2 insignificant and unstable in sign across the equations. A large nonwhite population, however, appears to increase the demand for police and fire employees, with the NONWHT coefficients in the linear equations positive and significant in each case (the log-linear coefficients are insignificant). Presumably, this reflects the poverty associated with a large nonwhite population, which places extra demands on police and fire departments.

As for the two variables measuring price effects, higher house values appear to raise the demand for fire protection (as one would expect), with both MEDVAL coefficients positive and close to significant in the fire equations. While a higher MEDVAL has no effect in the police equation, higher house values appear to lower the demand for sanitation workers, an effect which may capture the more modest sanitation needs of suburban communities. Contrary to expectations, communities with greater access to outside revenue sources do not generally have higher demands for public employee labor. While the IGOVREV coefficients in Table 2 show the expected positive sign in five out of six cases, only the linear fire equation's coefficient is significant.

Given that the curves estimated in Table 2 exhibit many of the properties of demand curves, it seems safe to conclude that the data is broadly consistent with the demand-constrained model of collective bargaining. Armed with this

knowledge, we can then test for the operation of bureaucratic self-interest by seeing how the demand curve responds to a change in the community competition variable. Since a higher value of COMP reduces the bureaucrat's ability to pursue self-interest, we expect to find negative COMP coefficients (indicating a downward shift in demand as competition increases). Referring to Table 2, it is immediately clear that the results are inconsistent with the self-interest hypothesis. COMP's coefficient is insignificant in the linear police equation and in each of the fire and sanitation equations, and is significantly positive in the log-linear police equation. Therefore, the results show no evidence of the operation of bureaucratic self-interest in the collective bargaining process.

It should be noted that this conclusion is not entirely robust to the specification of the equations. In particular, when L is regressed on w instead of vice versa, the fire equations show significantly negative COMP coefficients (the other equations again show no COMP effect). The fact that this outcome disappears in the w-on-L regressions suggests, however, that it cannot be taken too seriously.[16] Other changes in the reverse regressions are that the police INC coefficients become insignificant, the POPDEN effect on demand becomes less consistently positive (as do the NONWHT effects on police and fire demand), and that the MEDVAL effect disappears in the fire equations. Also, while the wage coefficients are generally negative, they are less frequently significant than in Table 2.[17]

To see the connection of the present results with earlier work, it is interesting to consider the wage equations from the reduced form of the present model. This is the kind of equation that has been estimated in most other work on public sector labor markets. Table 3 shows linear and log-linear wage equations for the three samples. The table shows that police and fire wages

are increasing in POP, POPDEN, INC, NONWHT, and MEDVAL. Moreover, police and fire wages are higher outside the south (the default region) and are high where manufacturing wages are high and where the work force is highly unionized (unemployment effects are not significant). In contrast, the wages of sanitation workers show little systematic relation to the explanatory variables (population density has a positive effect, as does location in a western state). This outcome could be the result of imprecision in the estimates due to the relatively small size of the sanitation sample.

Turning to the COMP variable, Table 3 shows that greater community competition leads to higher police and fire wages. Given that bureaucratic effects have been ruled out, it is tempting to attribute this outcome to the monopsony effect used to explain similar findings in previous studies. Under this effect, a weakening of monopsony power due to increased community competition leads to higher wages. The problem with this explanation is that the monopsony effect emerges in a situation where employers exert market power in their hiring practices when faced with a competitive supply of labor. Under demand-constrained bargaining, however, labor supply is controlled by the union, which exercises its own monopoly power in the bargaining process. The monopsony effect is therefore not relevant in the present context, which means that some other explanation of the effect of COMP on police and fire wages must be sought.

Referring back to Table 2, the significantly positive COMP coefficient in the log-linear police equation suggests that police demand increases with community competition. It is likely that the positive impact of COMP on police wages reflects this demand shift. Although the reason for the demand shift is not clear, it could be that COMP is picking up demand effects related to the

overall size of the metropolitan area (police demand may be high in communities that are part of a large metropolis due to negative spillover effects).[18]

Since Table 2 shows no evidence of a COMP effect on fire demand, the positive fire wage effect cannot be attributed to a demand shift. A clue as to the origin of the effect is given by the reduced form *L* equations, which show that an increase in COMP reduces fire hours (COMP effects are absent in the *L* equations for police and sanitation). Thus, although the fire demand curve is itself unaffected by COMP, the bargaining outcome moves up along the curve as COMP increases, with *w* rising and *L* falling. This type of movement is consistent with descriptions of the goals of firefighter unions found in the literature, which portray the unions as attempting to shorten the work week. Evidently, the unions are more successful in achieving this goal when community competition is stronger. The exact mechanism for this effect is unclear but could be the subject of further research.[19]

6. Conclusion

This paper has tested for the operation of bureaucratic self-interest in collective bargaining outcomes for police, fire, and sanitation workers. The results show the absence of a self-interest effect, indicating that a consumer-sovereignty model of local government behavior may be accurate. This finding is consistent with the conclusions of McGuire (1981) but inconsistent with the results of Mehay and Gonzalez (1986), Ott (1980), Romer and Rosenthal (1982), Shapiro and Sonstelie (1982), and Sjoquist (1982), who interpret their findings as favoring the bureaucracy framework.

Along the path to its empirical conclusion, the paper offered several innovations. The first of these is development of a bureaucratic model of collective bargaining that shows explicitly how self-interest affects the bargaining outcome under the demand-constrained and efficient-bargain

frameworks. Secondly, the paper's approach to discriminating between the two frameworks, which involves sequential estimation of the contract curve and demand curve, is different from previous methods. This approach could be applied in future research designed to discriminate between the two bargaining models.

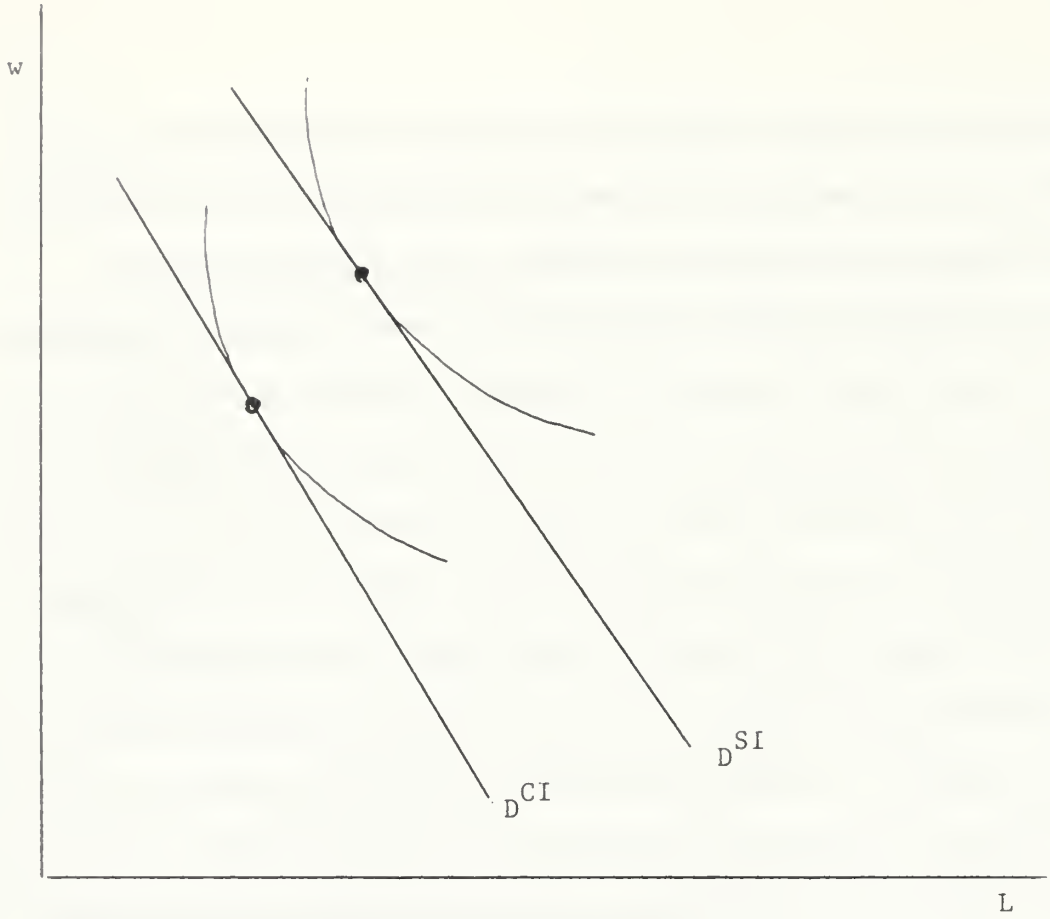

Fig. 1

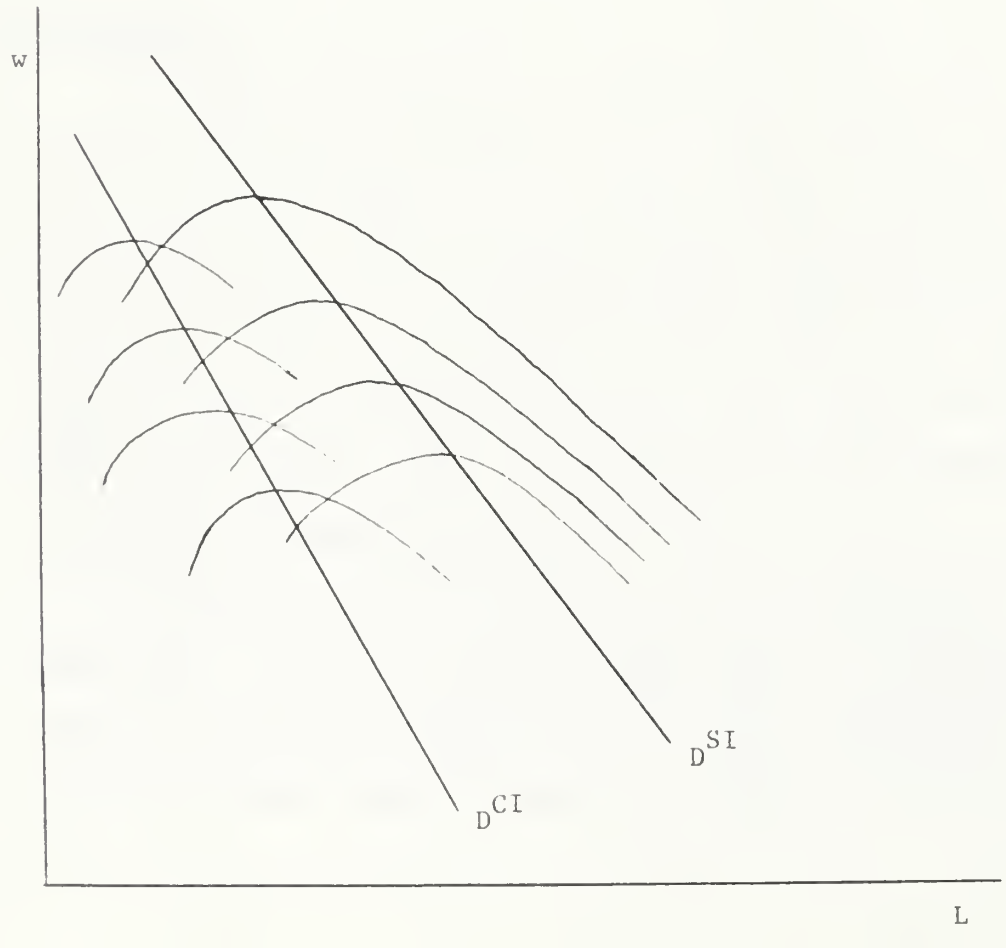

Fig. 2

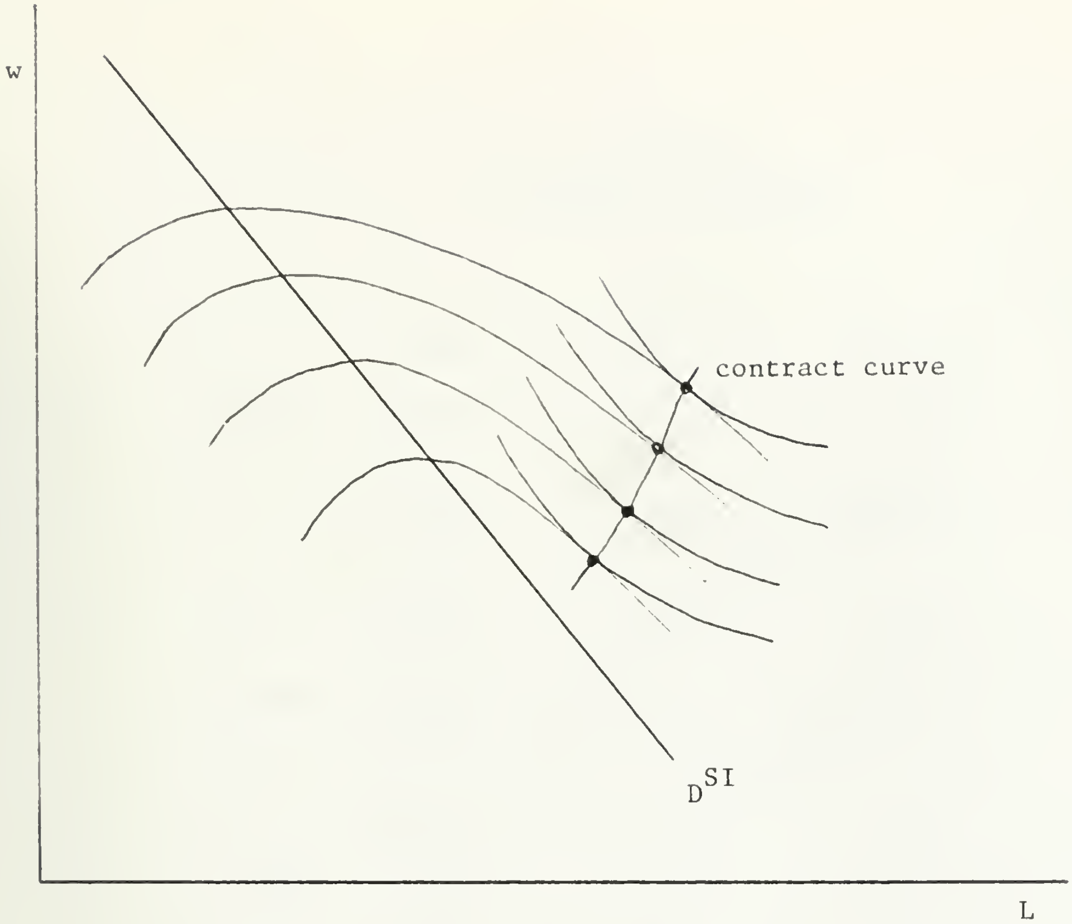

Fig. 3

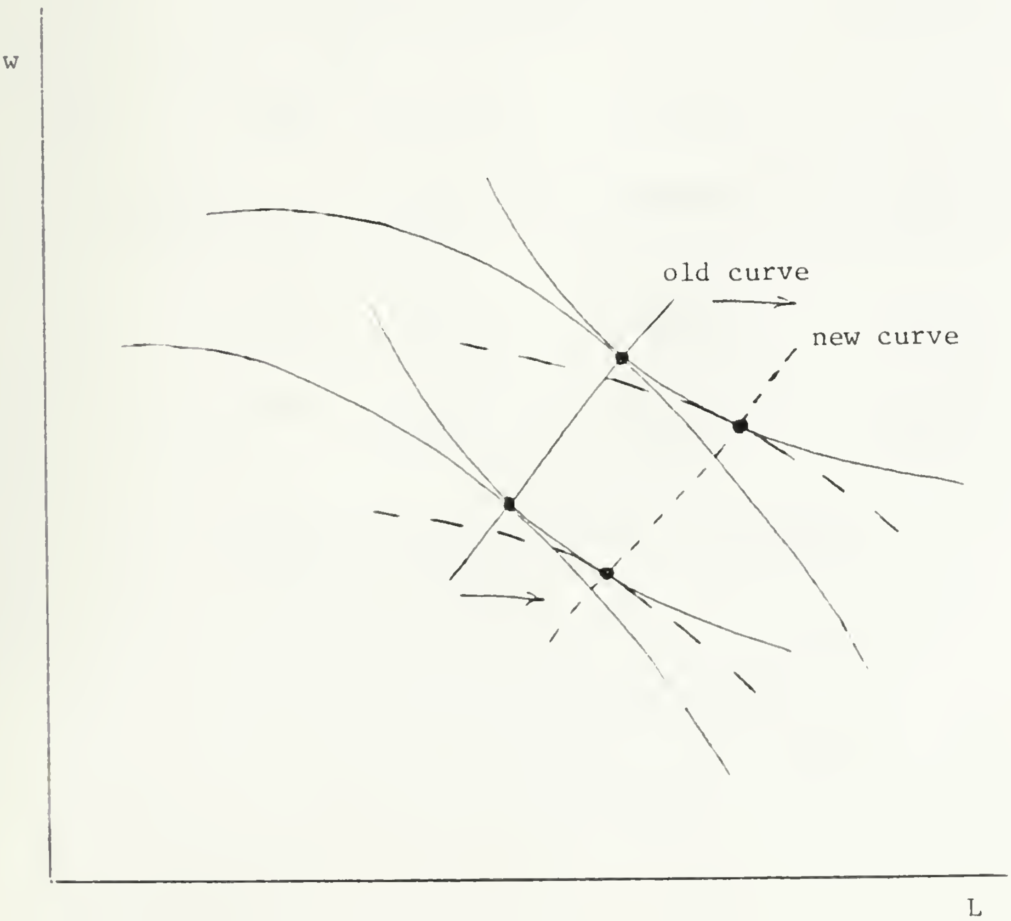

Fig. 4

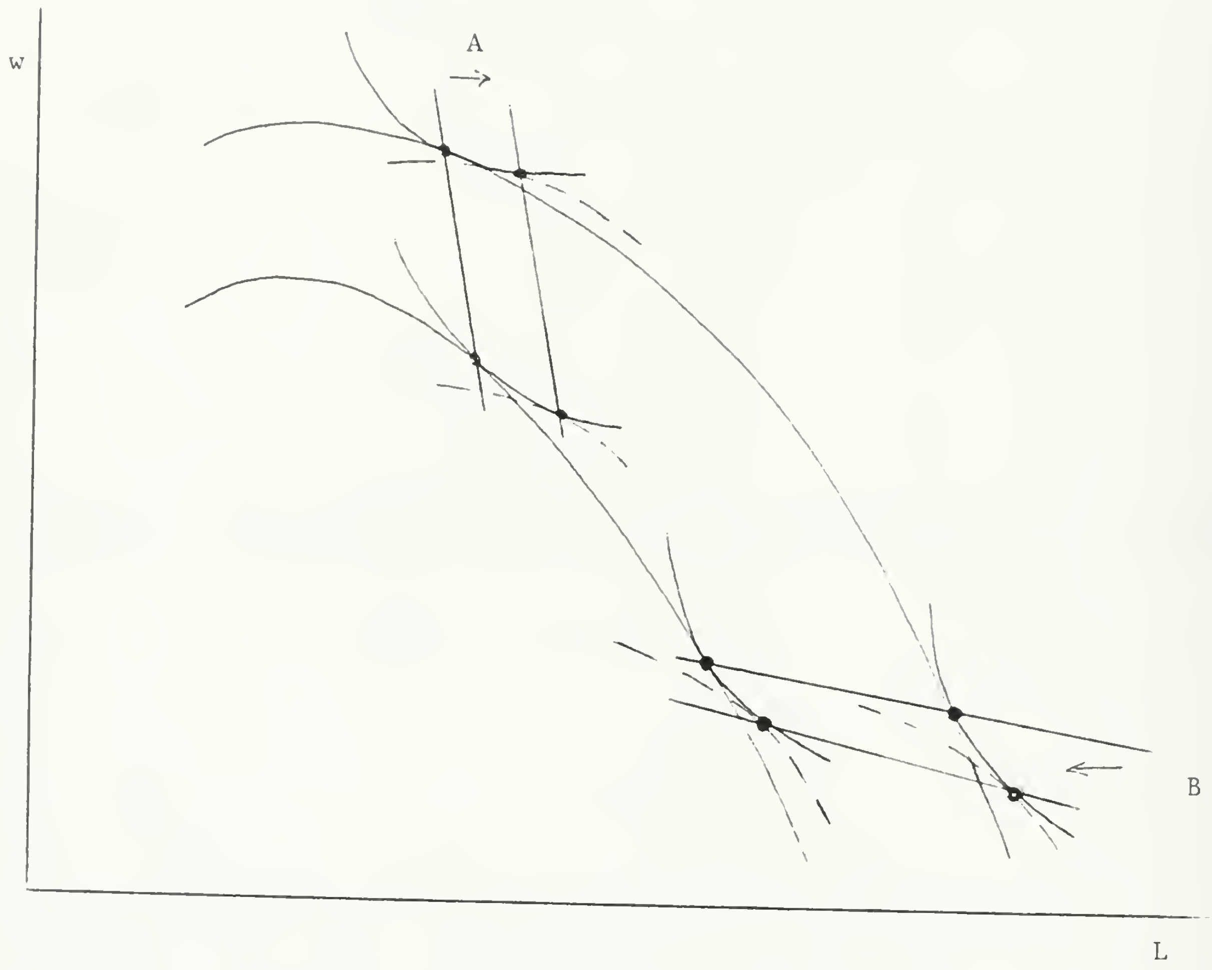

Fig. 5

Table 1
2SLS Contract Curve Estimates
(Log-Linear Equations)

	POLICE	FIRE	SANITATION
CONST	2.28 E+00 (2.74)	3.41 E+00 (2.49)	-1.23 E+00 (-0.74)
L	-4.13 E-01 (-2.58)	-4.46 E-01 (-2.49)	-3.64 E-01 (-2.58)
POP	4.83 E-01 (2.80)	5.14 E-01 (2.84)	3.30 E-01 (2.19)
POPDEN	5.84 E-02 (2.18)	1.15 E-01 (4.29)	2.69 E-01 (2.64)
INC	-3.22 E-02 (-0.32)	-2.62 E-01 (-1.56)	2.36 E-01 (0.56)
HSDEG	4.48 E-02 (0.66)	-1.57 E-01 (-1.69)	7.26 E-01 (1.57)
NONWHT	1.88 E-02 (1.25)	-1.15 E-03 (-0.08)	4.95 E-02 (0.88)
MEDVAL	1.20 E-01 (2.42)	2.02 E-01 (3.48)	-1.88 E-01 (-0.96)
IGOVREV	-3.31 E-02 (-0.90)	2.32 E-02 (0.56)	4.83 E-02 (0.43)
MFGW	4.51 E-01 (4.25)	4.33 E-01 (3.88)	4.32 E-01 (1.11)
UNEMP	1.16 E-01 (1.53)	3.70 E-02 (0.47)	1.44 E-01 (0.45)
COMP	4.31 E-02 (2.66)	1.77 E-02 (0.85)	3.28 E-02 (0.45)

Dependent variable is the wage; L is endogenous

t-ratios in parentheses

Table 2
2SLS Demand Curve Estimates

	POLICE		FIRE		SANITATION	
	log-linear	linear	log-linear	linear	log-linear	linear
CONST	2.34 E+00 (3.15)	4.24 E+00 (3.16)	3.08 E+00 (2.46)	5.19 E+00 (2.61)	-5.68 E-01 (-0.32)	8.27 E+00 (1.18)
L	-3.31 E-01 (-2.39)	5.24 E-05 (0.53)	-3.62 E-01 (-2.19)	-4.71 E-04 (-2.88)	-4.42 E-01 (-2.47)	-1.45 E-04 (-0.37)
POP	3.98 E-01 (2.68)	-5.04 E-03 (-0.38)	4.32 E-01 (2.58)	3.41 E-02 (3.05)	4.12 E-01 (2.21)	5.00 E-03 (0.50)
POPDEN	9.09 E-02 (3.78)	2.20 E-01 (3.60)	1.36 E-01 (5.39)	3.01 E-01 (4.50)	3.10 E-01 (2.89)	7.07 E-01 (1.99)
INC	2.40 E-01 (2.74)	2.27 E-01 (5.25)	3.48 E-02 (0.24)	1.08 E-01 (1.56)	4.17 E-01 (0.90)	1.94 E-01 (0.72)
HSDEG	6.22 E-02 (0.96)	1.96 E-02 (1.13)	-1.01 E-01 (-1.15)	-9.30 E-03 (-0.39)	8.75 E-01 (1.77)	2.54 E-02 (0.25)
NONWHT	1.98 E-02 (1.40)	2.55 E-02 (2.23)	4.32 E-03 (0.30)	3.83 E-02 (2.78)	5.02 E-02 (0.80)	-3.74 E-02 (-0.50)
MEDVAL	2.85 E-02 (0.63)	6.94 E-03 (0.91)	1.00 E-01 (1.93)	1.56 E-02 (1.54)	-3.44 E-01 (-1.89)	-8.38 E-02 (-1.85)
IGOVREV	6.26 E-03 (0.19)	1.09 E-02 (0.90)	5.02 E-02 (1.26)	3.80 E-02 (2.09)	7.19 E-02 (0.60)	-5.11 E-02 (-1.03)
COMP	3.46 E-02 (2.24)	1.75 E-02 (1.45)	1.98 E-02 (1.00)	-1.65 E-02 (-0.81)	3.66 E-02 (0.46)	-2.74 E-02 (-0.13)

Dependent variable is the wage; L is endogenous

t ratios in parentheses

Table 3
OLS Wage Equation Estimates

	POLICE		FIRE		SANITATION	
	log-linear	linear	log-linear	linear	log-linear	linear
CONST	4.43 E-01	3.14 E-01	-2.16 E-01	-9.68 E-01	-2.36 E+00	-1.24 E+00
	(1.50)	(0.22)	(-0.58)	(-0.63)	(-1.17)	(-0.14)
POP	4.32 E-02	1.62 E-03	7.47 E-02	1.89 E-03	-4.26 E-03	9.55 E-05
	(3.47)	(2.97)	(5.30)	(3.71)	(-0.06)	(0.02)
POPDEN	7.26 E-02	1.99 E-01	5.56 E-02	1.16 E-01	2.11 E-01	5.57 E-01
	(4.06)	(4.50)	(2.59)	(2.73)	(2.03)	(1.61)
INC	8.59 E-02	1.05 E-01	4.37 E-02	9.26 E-02	-1.83 E-01	-1.42 E-02
	(1.26)	(2.48)	(0.51)	(2.02)	(-0.42)	(-0.05)
HSDEG	9.07 E-03	1.75 E-02	-3.58 E-02	1.19 E-02	1.02 E+00	4.61 E-02
	(0.20)	(1.20)	(-0.54)	(0.72)	(1.92)	(0.40)
NONWHT	1.74 E-02	3.33 E-02	2.54 E-02	4.65 E-02	-1.18 E-03	-8.88 E-03
	(1.65)	(3.32)	(2.11)	(4.88)	(-0.02)	(-0.14)
MEDVAL	9.16 E-02	1.46 E-02	1.68 E-01	2.00 E-02	-2.87 E-01	-2.88 E-02
	(2.12)	(1.89)	(3.23)	(2.55)	(-1.32)	(-0.54)
IGOVREV	2.85 E-03	-1.66 E-03	3.38 E-02	1.31 E-03	-3.35 E-02	-3.20 E-02
	(0.12)	(-0.15)	(1.11)	(0.11)	(-0.28)	(-0.59)
MFGW	3.43 E-01	6.96 E-01	3.14 E-01	4.74 E-01	2.74 E-01	1.30 E-02
	(4.18)	(4.05)	(3.49)	(3.07)	(0.67)	(0.01)
UNEMP	-7.23 E-02	-8.53 E-02	6.50 E-02	6.98 E-02	1.50 E-01	5.69 E-01
	(-1.35)	(-0.86)	(1.01)	(0.71)	(0.37)	(0.97)
REGNE	6.08 E-02	7.58 E-01	2.07 E-01	2.34 E+00	1.78 E-01	1.82 E+00
	(1.27)	(1.26)	(3.79)	(4.05)	(0.63)	(0.55)
REGNC	1.02 E-01	1.05 E+00	7.30 E-02	8.80 E-01	1.52 E-01	1.74 E+00
	(2.15)	(1.85)	(1.41)	(1.66)	(0.69)	(0.62)
REGW	1.36 E-01	1.66 E+00	1.14 E-01	1.27 E+00	3.56 E-01	3.80 E+00
	(3.31)	(3.32)	(2.46)	(2.69)	(1.77)	(1.39)
UNION	1.24 E-01	3.53 E-02	1.15 E-01	2.10 E-02	2.08 E-01	4.59 E-02
	(3.40)	(3.06)	(2.87)	(2.00)	(1.12)	(0.77)
COMP	3.82 E-02	1.35 E-02	4.62 E-02	2.01 E-02	2.88 E-02	-7.26 E-02
	(3.35)	(1.25)	(3.49)	(1.85)	(0.37)	(-0.34)

Dependent variable is the wage; t-ratios in parenthesis

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Footnotes

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[1]It would also be possible to test for bureaucratic self-interest in a nonunionized setting. However, since it appears that pursuit of self-interest is more easily disguised by bureaucrats in the collective bargaining process, this context is likely to be more fruitful for the study.

[2]Hamilton (1978) also uses a community competition variable in his study of the effect of zoning on housing prices. He hypothesizes that local governments' ability to raise housing prices (benefitting landowners) through the use of zoning practices is limited by community competition.

[3]It should be noted that this type of argument invalidates the estimates of income elasticities of demand derived by Bergstrom and Goodman (1973), Borcherding and Deacon (1972), and similar subsequent studies.

[4]The appearance of L in the utility function could also reflect the political power of public employees as an interest group. Bureaucrats wishing to guarantee their own longevity may need to cater to this group by guaranteeing high public employment levels. For a theoretical model based on this idea, see Courant et al. (1979).

[5]The derivative of (2) with respect to L equals

$$A \equiv D_L + U_Z^{-3}(U_{ZZ}U_L^2 - 2U_{ZL}U_ZU_L + U_{LL}U_Z^2),$$

which is negative given $D_L < 0$ and strict quasi-concavity of U.

[6]In the case where w and L are normal goods in the union utility function and the SI and CI demand curves happen to be parallel, both w and L are higher under SI. Nonparallel demand curves may overturn this result, however, even under the normality assumption.

[7]The question is whether the new tangency lies above or below the rectangular hyperbola passing through the original tangency point. Either outcome is possible, although the latter is implausible.

[8]Since the bureaucrat's indifference curves are not guaranteed to be everywhere concave, the optimality of the tangency points is also not guaranteed and must be assumed.

[9]Under McDonald and Solow's version of the utility function, indifference curves are asymptotic to a horizontal line at height w_a, which implies that the contract curve stops where this line intersects the demand curve. This outcome need not occur in a more general formulation.

[10]Sufficient conditions for an upward-sloping contract curve in the present model are that w and L are normal in the both the bureaucrat and union

indifference maps. While normality imposes the usual restrictions on the union indifference curves, this condition means that the bureaucrat curves become flatter (steeper) moving vertically (horizontally) in the (w, L) plane. The proof of the above fact is available on request.

[11]The conclusions drawn from Figures 4 and 5 can be derived analytically. Computations show that holding w fixed, the derivative of the L value on the contract curve with respect to σ has a sign opposite to that of the derivative of the contract-curve w value with respect to the bureaucrat's utility level. Recalling that lower bureaucrat indifference curves correspond to higher utility levels, it is easy to see from Figure 4 that w decreases as the bureaucrat's utility rises along an upward-sloping contract curve. The same thing happens along a downward-sloping curve like that of case A in Figure 5. The above result shows that in these cases, L must rise with σ, indicating a rightward shift in the contract curve. In case B of Figure 5, w rises as the bureaucrat's utility increases, which means that L must fall with σ (indicating a leftward shift of the contract curve). It should also be noted that case A of Figure 5 is ruled out when both the bureaucrat and union indifference maps exhibit normality of L. Proofs of the above facts are available on request.

[12]For example, the 1982 Census of Governments reports that of the 1,089,736 organized municipal employees (those represented by a bargaining unit), 1,002,546 were covered by contractual agreements.

[13]The fact that work weeks are different for uniformed and nonuniformed fire employees was taken into account in computing total fire hours.

[14]This analysis reflects the assumption that intergovernmental revenue comes in the form of a matching grant rather than a block grant.

[15]Note that the implied wage elasticities of demand from the log-linear equations (the reciprocals of the w coefficients) are implausibly large, with values between -2 and -4. When L is regressed on w, however, the elasticities are -.32, .-.25, and -1.38 for the three services.

[16]Another way of checking this conclusion is to regress the budget wL on all the exogenous variables in the model. Recall that while budget is not guaranteed to increase with self-interest, such a result is likely as the demand curve shifts up. The results show insignificant COMP coefficients in all equations, confirming the absence of a self-interest effect. This conclusion contradicts the findings of Sjoquist (1982).

[17]The t-ratios for the population coefficients also increase dramatically, with the coefficients themselves showing population elasiticities near unity in the log-linear equations.

[18]Although the MEDVAL, POPDEN, and INC variables should capture the metropolitan size effect to some extent (being higher in large metro areas), COMP captures any such effect most directly.

[19]It should be noted that one aspect of the L equations does not conform to the predictions of the theory. While the positive MFGW coefficients in the w equations should be accompanied by negative MFGW coefficients in the L

equations (indicating that the bargaining outcome moves up along the demand curve as MFGW rises), the latter *L* coefficients are in fact always positive (though usually insignificant).

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